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70 YEARS OF CREATING TOMORROW

Los Alamos NATIONAL LABORATORY

Defense Systems and Analysis Division Overview

November 2014

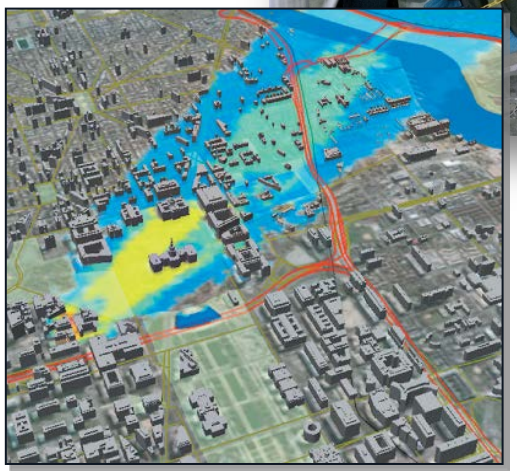
UNCLASSIFIED

Operated by Los Alamos National Security, LLC for the U.S. Department of Energy's NNSA

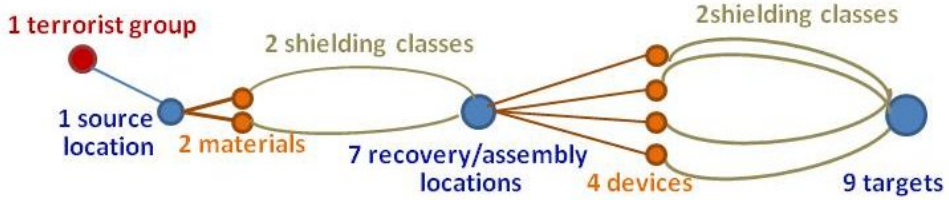
NNSA National Nuclear Security Administration

Mission

- We solve national security challenges by applying simulation, modeling and analysis to complex systems and by providing integrated system solutions
- Our sponsors include
  - Department of Defense
  - Department of Homeland Security
  - Intelligence Community
  - Nuclear weapons program

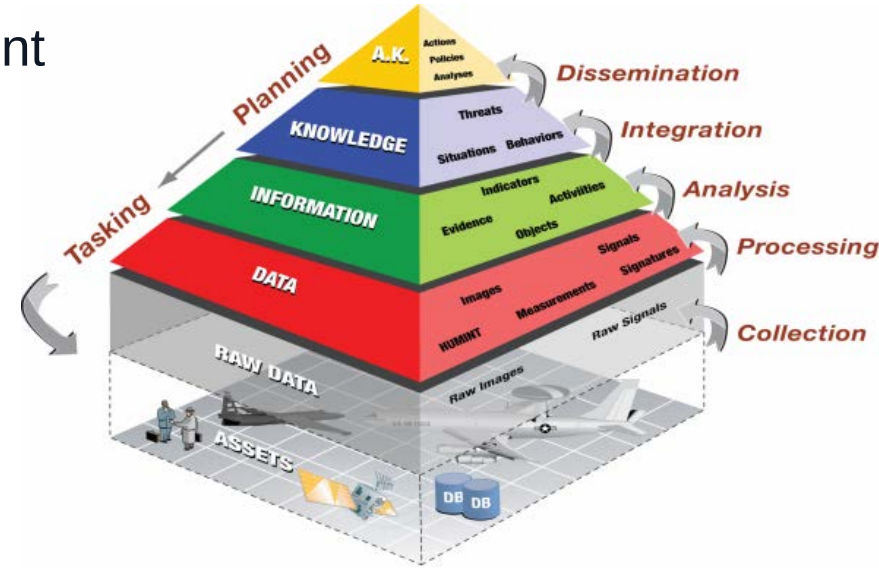


CBR Dispersion Modeling



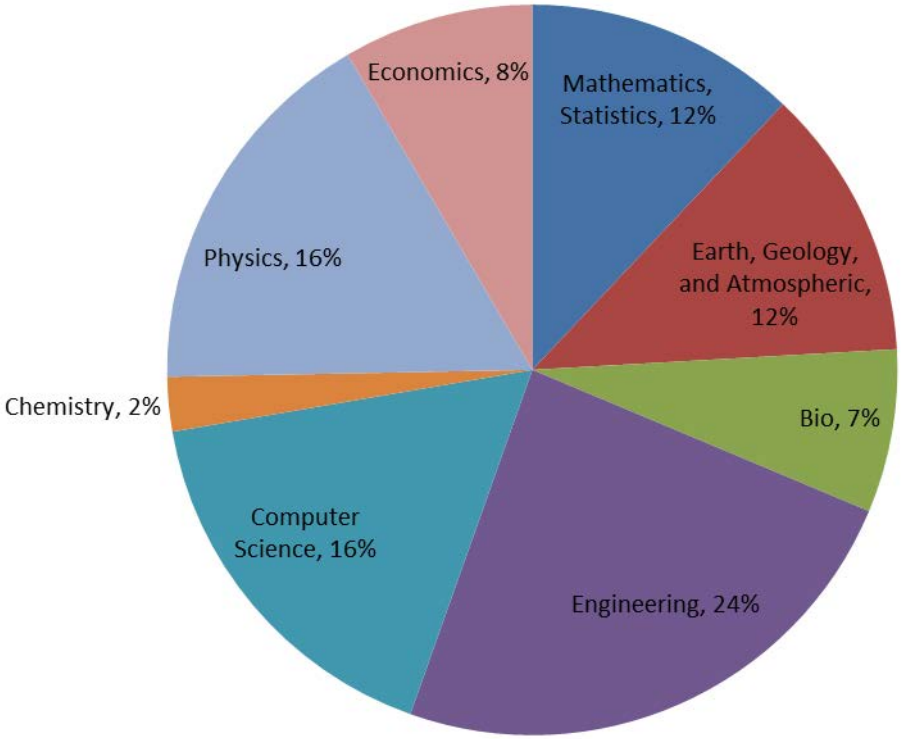
Competencies

- Complex systems modeling and simulations of engineered, physical and social systems
  - Engineered Bio Systems
  - Resilient Infrastructure Systems – Power, Water, Transportation
  - Urban Environments
    - Epidemic modeling, CBRE Dispersion, Population Mobility
  - Terrorist Networks
- Integrated systems for field deployment
  - Persistent surveillance
  - Bio surveillance, including assay testing
- Data analytics
  - Decision support tools
  - Situational awareness tools
- Cyber-physical security

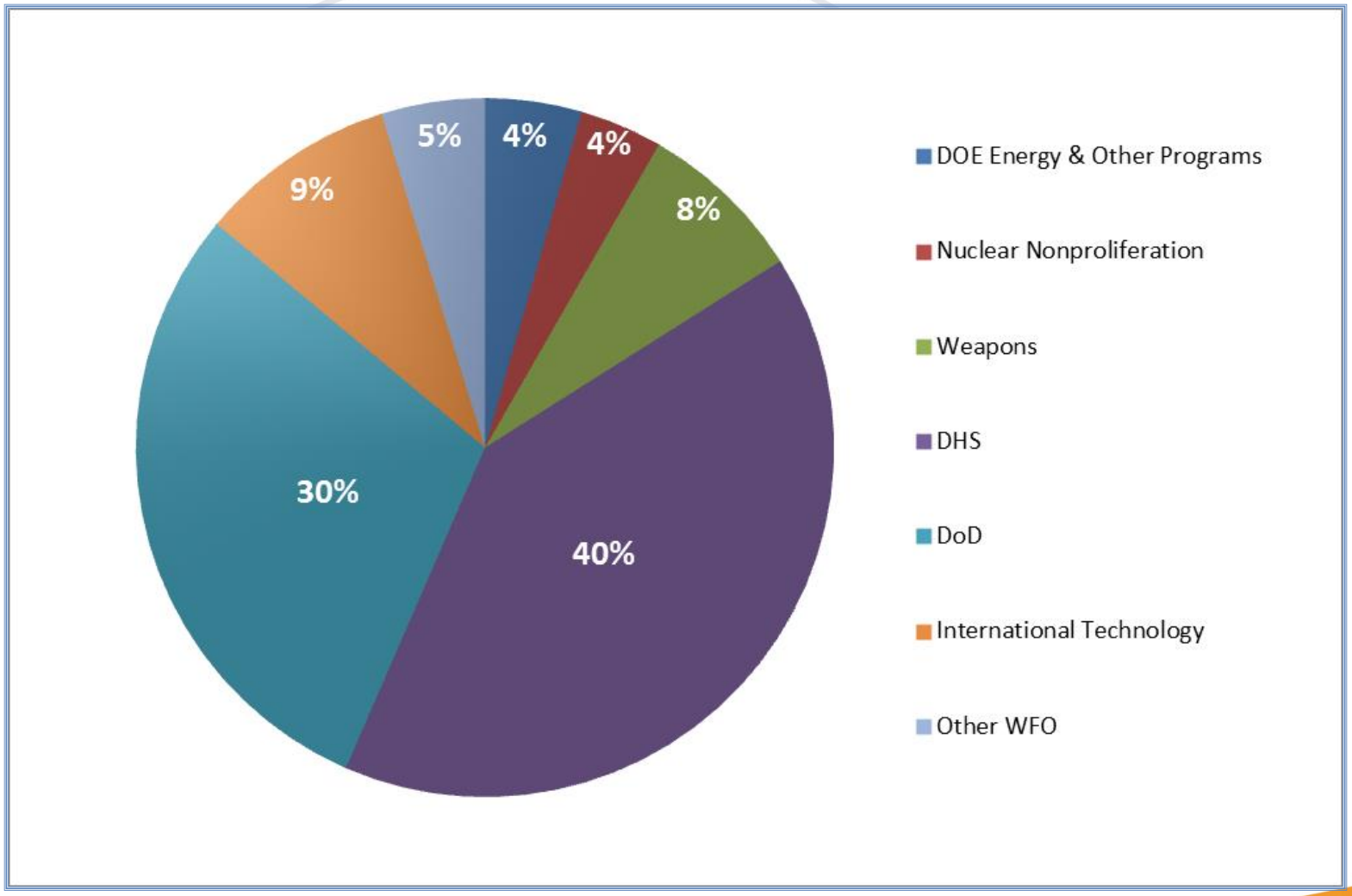


Demographics

- Division-wide
  - 53 PhD, 17 Masters, 15 Bachelors
  - 24% Engineering
  - 18% Chemistry and Physics
  - 16% Computer & Information Sciences
  - 12% Earth, Environmental, Atmospheric
  - 12% Mathematics, Statistics
  - 8% Economics
  - 7% Biology
  - 2% Chemistry



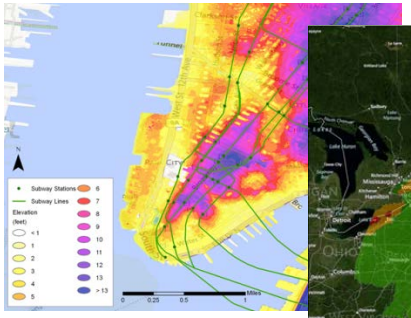
Funding


4%
4%
8%
40%
30%
9%
5%
DOE Energy & Other Programs
Nuclear Nonproliferation
Weapons
DHS
DoD
International Technology
Other WFO

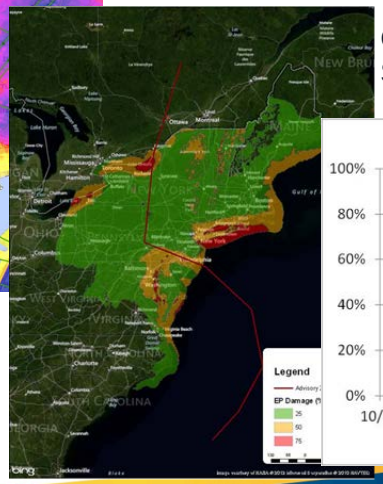
Recent Projects

- DOE Grid Science
  - Interdisciplinary complex system research and development project to understand future energy system resilience
  - Power System Engineering, Mechanical Engineering, Physics, Computer Science, and Optimization

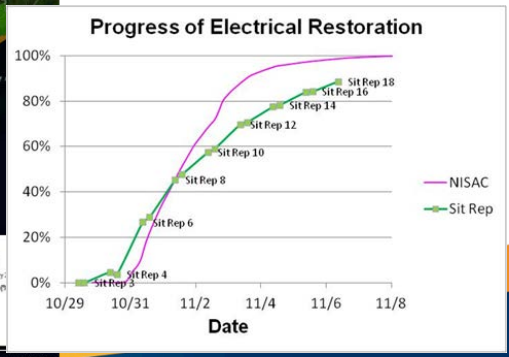
- National Infrastructure Simulation and Analysis Center
  - National security project focused on improving infrastructure system resilience to all-hazards
  - Power System Engineering, Mechanical Engineering, Civil Engineering, Physics, Computer Science, and Operations Research



Event Characterization



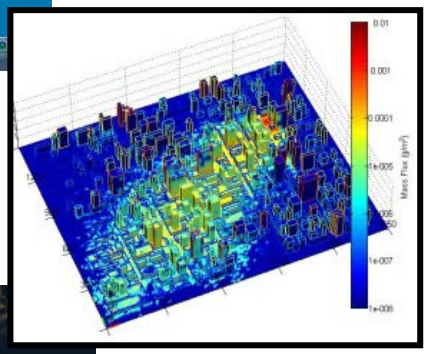
Cascading Effects in Complex System and Restoration Dynamics



Recent Projects

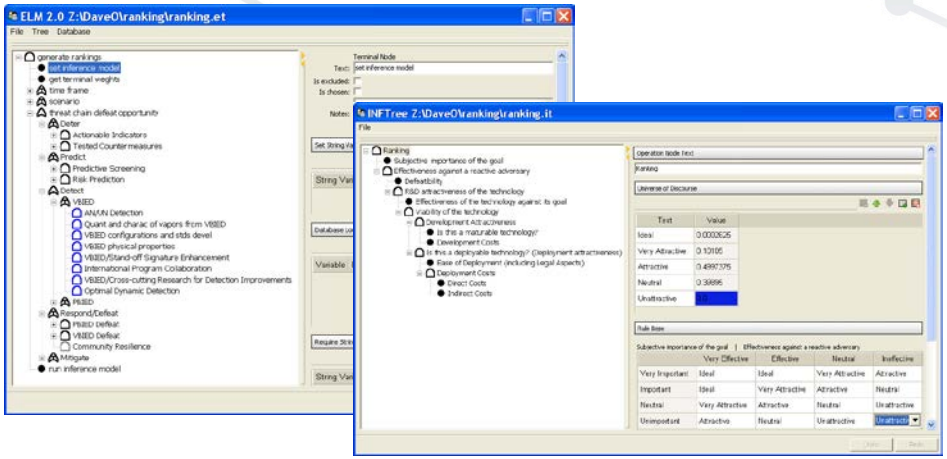
Defense Systems for Global Health Security

- **BioWatch:** *DHS program to mitigate the threat of a bio-attacks in major US cities.*
- **Bio Event Reconstruction Team (BERT) & Sensor Siting –** *Rapid response team providing critical data in the event of a bio threat. Complex analysis to determine optimal placement of limited sensor capabilities.*
- **Quick Urban & Industrial Complex (QUIC):** *Internationally utilized tool providing fast-running state-of-the-art building and terrain-aware atmospheric dispersion modeling of CBR plumes.*
- **Biosurveillance Resource Directory:** Web-hosted directory that links local, national, and global biosurveillance communities for early detection, situational awareness, and consequence management of health threats.
- **Engineered Bio Systems:** Rapid assessment of drug interactions without animal trials. Advanced research in human/machine interfaces.

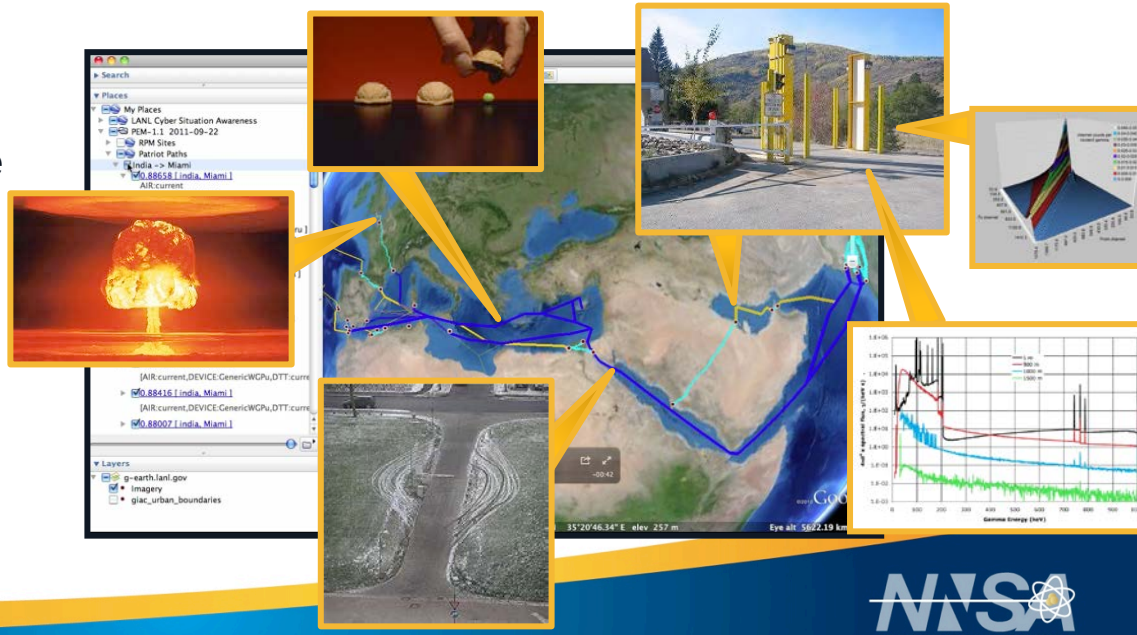


Recent Projects

- Extensible Logic Modeling
  - Formal specification-enabled expert elicitation
  - Comprehensive, detailed scenario enumeration made tractable
  - Threat assessments, vulnerability assessments, consequence estimation
  - Fully extensible; patented method



- Probabilistic Effectiveness Methodology
  - Unique national capability to perform integrated assessment of many diverse factors that contribute to the nation's risk of terrorist nuclear attack
  - National Academies reviewed



Potential Opportunities

- Persons with strong physics or engineering background, with interest in holistic systems analysis applied research (especially for global architectures of nuclear detectors)
- Computer scientist interested and/or experienced in cloud computing
- Persons with strong skills in software/GUI development for application of physics based models
- Computer scientist or applied mathematician interested in social media and predictive epidemiology
- Power system or mechanical engineer interested in research, development and application of models of electric power and natural gas transmission and distribution systems
- Electrical or mechanical engineer interested in research, development and application of models of cyber-physical systems
- Civil Engineer interested in research, development and application of models of water distribution and wastewater collection systems
- Computer scientist, operations researcher, or applied mathematician interested in research into large-scale nonlinear, mixed integer optimization. Application focuses include complex engineered networks (power, water, or natural gas systems) with problems related to system design, system resilience, interdiction and system control

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